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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

| (51) International Patent Classification 4 : | | (11) International Publication Number: |
|---|---|---|
| B23B 51/10 | A1 | WO 87/ 00100 |
| | | (43) International Publication Date: 15 January 1987 (15.01.87) |

(21) International Application Number: PCT/US85/01919

(22) International Filing Date: 3 October 1985 (03.10.85)

(31) Priority Application Number: 750,795

(32) Priority Date: 1 July 1985 (01.07.85)

(33) Priority Country: US

(71) Applicant: CATERPILLAR INC. [US/US]; 100 Northeast Adams Street, Peoria, IL 61629-6490 (US).

(72) Inventor: SALETRI, Richard, A. ; 115 Locust Street, Oswego, IL 60543 (US).

(74) Agents: McFALL, Robert, A. et al.; Caterpillar Tractor Co., 100 Northeast Adams Street, Peoria, IL 61629-6490 (US).

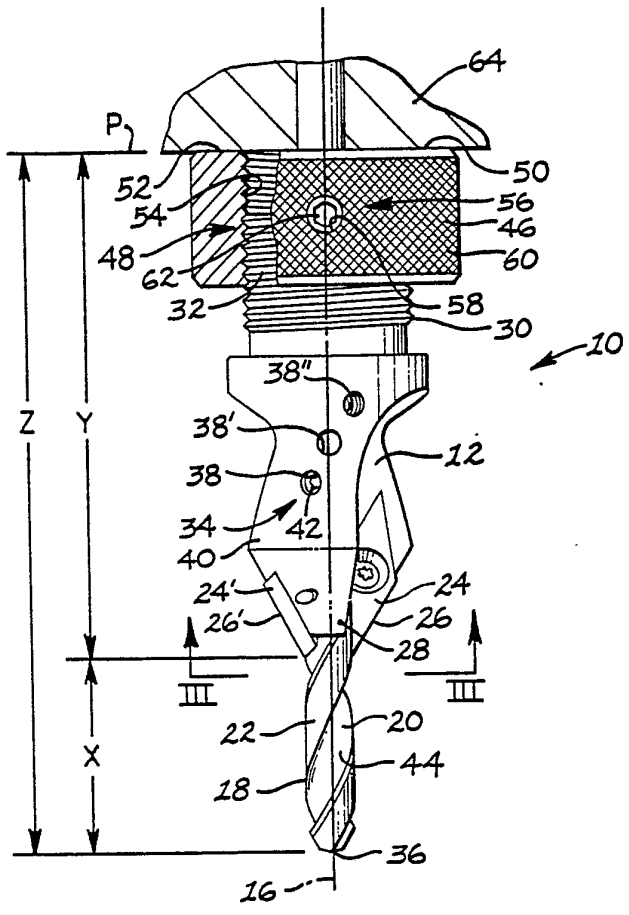
(81) Designated States: BE (European patent), DE (European patent), FR (European patent), GB (European patent), IT (European patent), SE (European patent).

Published
*With international search report.*
*With amended claims.*

(54) Title: ADJUSTABLE LENGTH CHAMFERING TOOL

(57) Abstract

A chamfering tool (10) for use with a rotary tool (18) for forming or tappping holes, includes a movable member (46) mounted on a body portion (12). The length of the chamfering tool (10) is varied in response to varying the position of the movable member (46) with respect to the body portion (12). Means (34, 56) are provided for separately maintaining the body portion (12) at a predetermined position on the rotary member (18), and for maintaining the movable member (46) at a desired position with respect to the body portion (12). The present invention provides a single chamfering tool (10) that is adaptable to a variety of length requirements. The chamfering tool (10) length may be adjusted before or after installation on a rotary tool (18).



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# Description

## Adjustable Length Chamfering Tool

### Technical Field

This invention relates generally to a rotary cutting tool and more particularly to a tool for cutting a chamfer relief around a hole.

### Background Art

Several tools have been proposed for simultaneously drilling or tapping and chamfering a hole. One form of such tools is a stepped drill or tap wherein the tool has an integrally-formed, radially extending cutting surface positioned at a fixed distance from the tip of the hole forming tool. Stepped tools are generally designed for specific applications, e.g. drilling and chamfering a blind hole of a predetermined depth. When employing stepped drills, a different tool is therefore required for each diameter of hole, and for each hole having a different depth.

This problem is partially overcome by having the chamfer cutting surface formed on, or provided by, a separate member attached to the hole-forming tool at a variable, preselected distance from the tip of the tool. Auxiliary chamfer tool arrangements if this type are described in U.S. Patent 3,233,260, issued February 8, 1966; U.S. Patent 3,575,520, issued April 20, 1971; and U.S. Patent 3,635,573 issued January 18, 1972; all to William Halpern. All of the Halpern devices are adapted for mounting at a selected position on a rotary drill or tap. However, since these devices have a fixed length, it is not possible to control both the

distance of the chamfer cutting surface and the distance of the distal end of the chamfering tool from the tip of the drill or tap.

The increasing use of computer controlled machine tools having automatic tool changers, requires that hole forming and chamfering tools be capable of independent positioning and adjustment with respect to the reference plane of a tool holder. Further, it is desirable that in its installed position, the distal end of the chamfer tool; i.e., the end spaced from the cutting surface, be firmly abutting the collet face of the tool holder. Firm contact with the face of the tool holder prohibits slipping of the chamfer tool along the longitudinal axis of the hole forming tool and, in cooperation with other retention devices, provides a positive drive for the chamfer tool. The prior art chamfer tools have fixed, non-adjustable lengths, and cannot be independently positioned on the hole forming tool to both solidly abut the face of the tool holder and simultaneously be variably positioned so that the cutting surface of the chamfer tool is at a preselected distance from the cutting tip of the hole forming tool.

The present invention is directed to overcoming one or more of the problems set forth above. In particular, a chamfer tool embodying the present invention includes a body portion that is adapted for mounting on a rotary tool for forming or tapping holes, and has a cutting surface at one end. The chamfer tool also includes an adjustable collar mounted on the body portion at an end opposite the cutting surface, the length of the chamfer tool being varied in response to changing the position of the movable collar on the body portion. Further, the

length of the chamfer tool may be pre-set prior to mounting on a rotary tool, or alternatively, adjusted to a desired length after mounting on the rotary tool.

Disclosure of the Invention

In accordance with one aspect of the present invention a chamfering tool includes a body portion having a cutting edge at one end and a movable member mounted on a second end of the body portion. The length of the chamfering tool is varied in response to changing the position of the movable member with respect to the body portion. The chamfer tool also includes means for maintaining the movable member at a preselected position on the body portion. The length of the chamfer tool may be pre-set to a desired length prior to installation on a rotary tool for forming or tapping holes, or adjusted and set to a desired position and length with respect to the rotary tool, or to a tool holder, after mounting the body portion on the rotary tool. Another feature of the chamfer tool includes a replaceable cutting edge mounted on the body portion.

Brief Description of the Drawings

Fig. 1 is a partially-sectioned elevational view of a chamfering tool embodying the present invention;

Fig. 2 is an enlarged elevational view of a portion of the chamfer tool shown in Fig. 1;

Fig. 3 is an end view of the chamfer tool as seen from lines III-III of Fig. 1; and

Fig. 4 is a partially sectioned elevational view of the chamfering tool as viewed from the right hand side of Fig. 1.

Best Mode for Carrying Out the Invention

A chamfering tool 10 for cutting a chamfer relief around a hole includes a body portion 12 having a bore 14 defined by an internally disposed cylindrical wall extending through the body portion concentrically with a longitudinal axis 16 of the body portion. The bore 14 is sized to snugly receive a rotary tool 18 for forming or tapping a hole. One example of such a rotary tool, a twist drill, is shown in the drawings and has a pair of helical flutes 20 separated by lands 22. The body portion 12 has a pair of indexable replaceable inserts 24, 24' mounted at a first end 28, each respectively having a cutting edge 26, 26' extending generally radially outwardly from a position radially inwardly of the bore 14, and a plurality of external threads 30 formed on an opposite, or second, end 32 of the body portion.

The chamfering tool 10 includes means 34 for mounting the body portion 12 on the drill 18 at a preselected distance X from the point or cutting end 36 of the drill. In the present embodiment, the body portion mounting means 34 includes a plurality of threaded holes, 38,38',38" extending radially between an outer surface 40 and the bore 14 of the body portion 12, and at least one screw 42 threaded into a selected one of the holes 38,38',38". The screw 42 should be of a length sufficient to engage a curved surface portion 44 of one of the flutes 20, and preferrably urge the body portion 12 in a clockwise direction, as viewed from the point end 36 of the drill 18, as the screw 42 is tightened. In this manner, the cutting edge 26,26' of the inserts will be drawn up tight against the side of the lands 22, in an abutting relationship with the lands, as shown in Figs. 3 and 4. For this reason, the threaded holes 38,38',38" are non-aligned with respect

to the helix angle of the flutes 20, so that a hole may be selected that is best positioned with respect to the curved flute surface 44 to provide a clockwise bias to the body portion 12 in response to tightening the screw 42. Although not required for retention purposes, it may be desirable to form a second set of holes 38,38',38" at a position radially opposed to the first set of holes, and insert a second screw 42 into one of the second set of holes, to avoid imbalance of the body portion 12 during rotation.

The chamfering tool 10 also includes a movable member 46 that is rotatably mounted on the second end 32 of the body portion 12, and a means 48 for selectively varying the position of the movable member 46 to vary the length Y of the chamfering tool 10. In the present embodiment, the movable member 46 is an adjustable collar having a planar abutment surface 50 at a distal end 52 of the collar 46. The means 48 for varying the length of the chamfering tool includes a plurality of internal threads 54 that mate with the external threads 30 on the second end 32 of the body portion 12. When mounted on the body portion 12, the collar 46 is concentric with the longitudinal bore 14, the planar abutment surface 50 of the collar is substantially perpendicular to the longitudinal axis 16 of the body portion 12, and the collar is radially spaced from the drill 18. The length Y of the chamfering tool 10, and an overall distance Z extending from the distal end 52 of the collar 46 to the point 36 of the drill 18, is varied by rotating the collar 46 in either a clockwise or counterclockwise direction with respect to the body portion 12.

A means 56 for maintaining the collar at a selected position on the second end 32 of the body portion 12 includes a radially directed threaded hole 58 extending between an outer surface 60 and the

internal threads 54 of the collar 46, and a screw 62 mounted in the threaded hole 58. Tightening the screw 62 will bring the end of the screw to bear against the external threads 30 of the body portion 12, and securely lock the collar 46 in a fixed relationship with the body portion 12.

Industrial Applicability

The chamfering tool 10 is particularly useful in automatically controlled machining applications in which a rotary tool is pre-set to extend a desired distance from a tool holder 64. In addition, it is often desirable, for reasons of economy, to simultaneously form the hole and cut a chamfer relief around the hole in a single operation. In these instances, particularly where a blind-bottom hole is formed, it may also be necessary to position the cutting edge of the chamfering tool a predetermined distance from the point end 36 of the drill 18. Furthermore, it is desirable to have the distal end of the chamfer tool in a solid abutting relationship with the tool holder to prevent axial slippage along the drill axis and assure a positive, constant drive force to the chamfering tool.

The illustrated embodiment allows one to independently adjust the position of a rotary cutting tool mounted in a tool holder and the position of a chamfering tool mounted on the rotary tool in an abutting relationship with the tool holder. By way of example assume that, in a workpiece, it is desired to drill and chamfer a hole 1.5 inches (3.81 cm) deep. Further the drill length is such that, when mounted in a tool holder 64, 4.5 inches (11.43 cm) of the drill body will extend beyond a reference plane P of the tool

holder. After mounting the drill in the tool holder 64, the chamfering tool 10 is installed on the drill 18 by first positioning the body portion 12 so that the distance X from the cutting edge 26 to the drill cutting end 36 is 1.5 inches (3.81 cm). Next, with the body portion held in position, the screw 42 is inserted in a selected one of the threaded holes 38, 38',38" in the body portion and tightened against the curved surface 44 of one of the flutes 20, to bias the cutting edges 26, 26' against a respective side wall of the lands 22. The tightened screw 42, bearing against the curved flute surface 44, maintains the body portion 12 at the first preselected distance X from the end 36 of the drill 18 and additionally maintains each of the cutting edges 26,26' in an abutting relationship with the side surface of a respective land 22.

After mounting the body portion 12 at the desired position, the collar 46 is rotated until the planar surface 50 on the distal end 52 of collar firmly abuts the tool holder 64. The collar 46 is maintained in an abutting relationship with the tool holder, at the desired distance of 4.5 inches (11.43 cm) from the end 36 of the drill 18, by tightening the screw 62 so that it bears against the second end 32 of the body portion 12.

Alternatively, the present embodiment permits installation of the chamfering tool 10 on a rotary tool 18 prior to mounting the rotary tool in a tool holder 64. In the alternative installation, the collar 46 is adjusted to a predetermined length Y by rotating the collar with respect to the body portion 12, and then locked at the desired position by tightening the lock-screw 62. The pre-set length chamfer tool is then installed at a desired position on the rotary tool.

The present embodiment further permits adjustment, or fine-tuning, of the respective tool elements after installation on a machine tool. The adjustable collar 46 allows the chamfering tool position to be adjusted in very small, well-defined, controllable increments. Thus, it should be recognized that the controllably adjustable features of the chamfering tool described above, and in the following claims, provide a tool that may be used in a variety of applications to overcome the need for a plurality of individual chamfer tools, each of differing lengths, for specific applications.

Other aspects, objects and advantages of this invention can be obtained from a study of the drawings, the disclosure and the appended claims.

## Claims

1. In a tool (10) for cutting a chamfer relief around a hole, said chamfering tool (10) having a body portion (12), a bore (14) extending through the body portion (12) concentric with a longitudinal axis (16) of said body portion (12) and adapted to receive a rotary tool for forming or tapping holes, means (34) for mounting the body portion (12) on the rotary tool (18) at a first preselected distance (X) from an end (36) of said rotary tool (18), and at least one radially extending cutting edge (26) disposed at a first end (28) of said body portion (12), the improvement comprising;

an adjustable collar (46) mounted on a second end (32) of said body portion (12), the collar (46) being concentric with the longitudinal bore (14) and spaced from the rotary tool (18) when the body portion (12) is mounted on said rotary tool (18), and means (56) for maintaining a distal end (52) of the collar (46) at a second preselected distance (Z) from the end (36) of said rotary tool (18), the difference between said first and second distances (X,Z) being variable in response to changing the mounted position of the collar (46) with respect to said body portion (18).

2. A chamfering tool (10), as set forth in claim 1, wherein the body portion (12) includes an external thread (30) at said second end (32), and the adjustable collar (46) includes an internal thread (54) mating with said external thread (30) on said body portion (18).

3. The chamfering tool (10), as set forth in claim 2, wherein the means (56) for maintaining the collar (46) at the second preselected distance (Z) includes at least one radially directed threaded hole (58) extending between an outer surface (60) and the internal threads (54) of the collar (46) and a fastener (62) mounted in said threaded hole (58).

4. A chamfering tool (10), as set forth in claim 1, wherein the adjustable collar (46) includes a planar abutment surface (50) at the distal end (52) of the collar (46), said planar surface (50) being substantially perpendicular to the longitudinal axis (16) of said body portion (12).

5. A chamfering tool (16), as set forth in claim 1, wherein the rotary tool (18) is a fluted cutting tool (18) having alternating lands (22) and flutes (20), the means (34) for mounting the body portion (12) on the rotary tool includes a plurality of radially directed threaded holes (38,38',38") extending between an outer surface (40) and the bore (14) of the body portion (12), and at least one screw (42) threaded into a selected one of said holes (38,38',38") and adapted to engage a surface portion (44) of one of the flutes (20) of said rotary tool (18).

6. A chamfering tool (10), as set forth in Fig. 5, wherein the flutes (20) and lands (22) of the rotary tool (18) are diagonally opposed and form a helical pattern on the tool (18), the radially directed threaded holes (38,38',38") in the body portion (12) are non-aligned with respect to the helical pattern of the flutes (20), and the cutting edge (26) disposed at the first end (28) of the body portion (12) includes a

pair of cutting edges (26,26') extending radially outwardly from a position radially inwardly of said longitudinal bore (14), a portion of each of said cutting edges (26,26') being maintained in an abutting relationship with a side surface of a respective land (22) in response to tightening the screw (42) in a selected one of said radially directed threaded holes (38,38',38") in said body portion (12).

7. A chamfering tool (10), as set forth in claim 1, wherein the radial cutting edge (26) at the first end (28) of the body portion (12) is formed on a removable insert (24).

8. A chamfering tool (10), comprising:

a body portion (12) having a bore (14) extending therethrough and concentric with a longitudinal axis (16) of said body portion (12), a first end (28) including at least one cutting edge (26) extending in a generally radial direction outwardly from said bore (14), a spaced second end (32), and a means (34) for mounting the body portion (12) on a rotary cutting tool (18);

a movable member (46) mounted on the second end (32) of said body portion (12);

means (48) for selectively varying the position of said movable member (46) to vary the length of the chamfering tool (10) as measured along said longitudinal axis (16); and

means (56) for maintaining the movable member (46) at a selected position on the second end (32) of said body portion (12).

9. A chamfering tool (10), as set forth in claim 8, wherein the movable member (46) is an adjustable collar (46) rotatably mounted on the second end (32) of the body portion (12), and the means (48) for selectively varying the length of the chamfering tool (10) includes an external thread (30) formed on the second end (32) of said body portion (12) and a mating internal thread (54) on the collar (46), the length of the chamfering tool (10) being varied in response to rotating the collar (46) with respect to the body portion (12).

10. A chamfering tool (10), as set forth in claim 9, wherein the adjustable collar (46) includes a planar abutment surface (50) at a distal end (52) of the collar (46), said planar surface (50) being substantially perpendicular to the longitudinal axis (16) of said body portion (12); and

the means (56) for maintaining the movable member (46) at said selected position includes at least one radially directed threaded hole (58) extending between an outer surface (60) and the internal threads (54) of the collar (46), and a fastener (62) mounted in said threaded hole (58).

11. A chamfering tool (10), as set forth in claim 8, wherein the rotary tool (18) is a fluted cutting tool (18) having alternatng lands (22) and flutes (20); and

the means (34) for mounting the body portion (12) on the rotary tool (18) includes a plurality of radially directed threaded holes (38,38',38") extending between an outer surface (40) and the bore (14) of the body portion (12), and at least one fastener (42)

threaded into a selected one of said holes (38,38',38") and adapted to contact a curved surface portion (44) of one of the flutes (20) of said rotary tool (18).

12. A chamfering tool (10), as set forth in claim 11, wherein the flutes (20) and lands (22) of the rotary tool (18) are diagonally opposed and form a helical pattern on the tool (18), the radially directed threaded holes (38,38'38") in the body portion being non-aligned with respect to the helical pattern of the flutes (20), and the radial cutting edge (26) disposed at the first end (28) of the body portion (18) includes a pair of cutting edges (26,26') extending radially outwardly from a position inwardly of said longitudinal bore (14), a portion of each of said cutting edges (26,26') being maintained in an abutting relationship with a side surface of a respective one of said lands (22) in response to tightening the screw (42) in a selected one of said radially directed threaded holes (38,38',38") in the body portion (12).

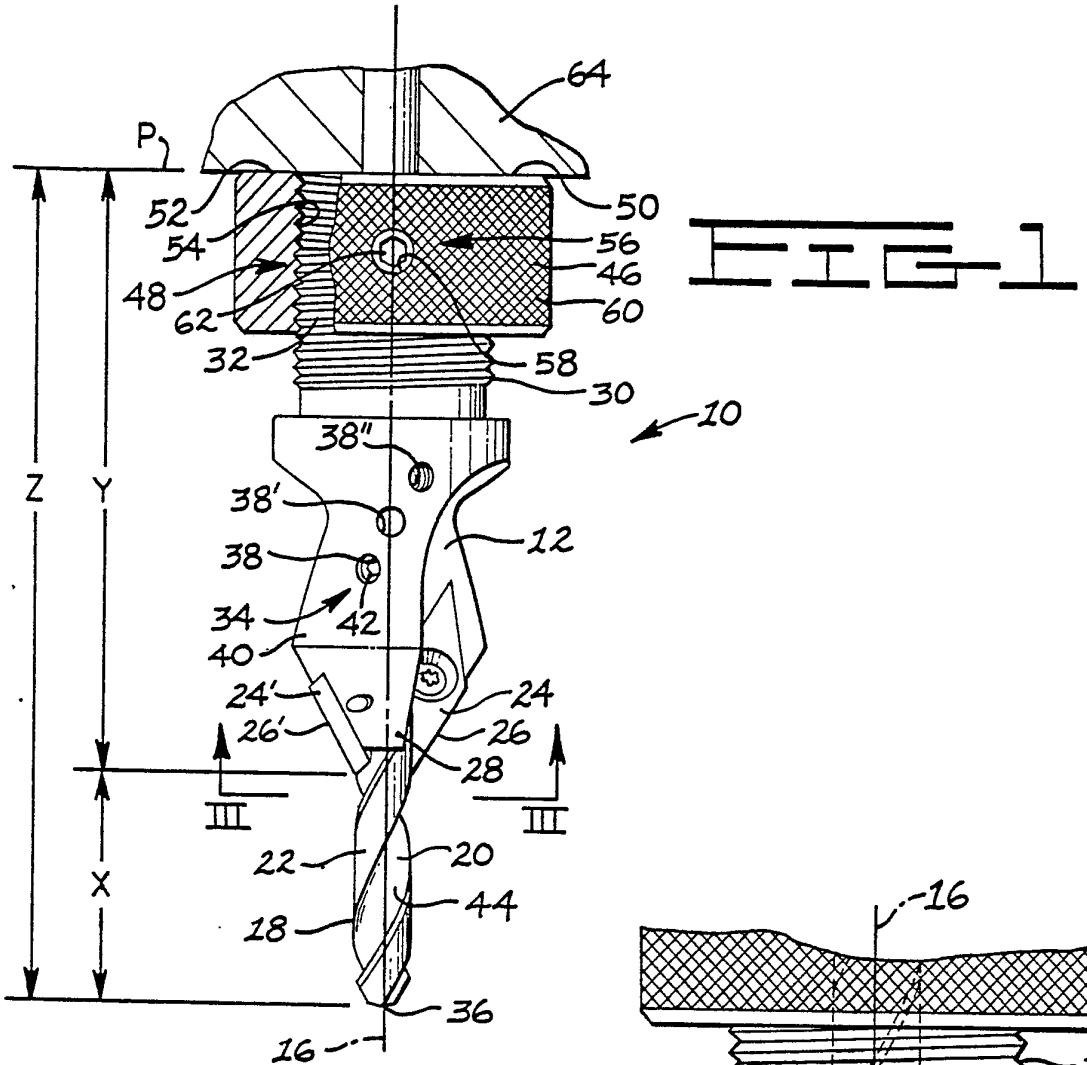
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FIG-1

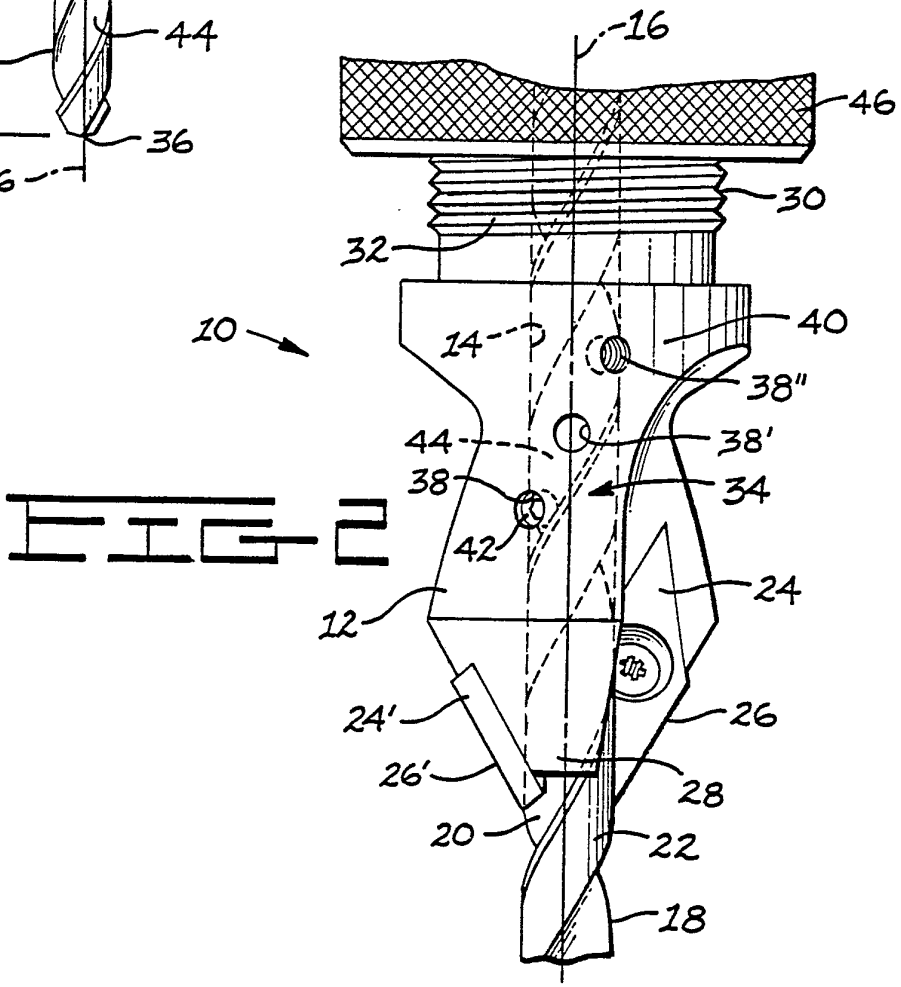
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FIG-2

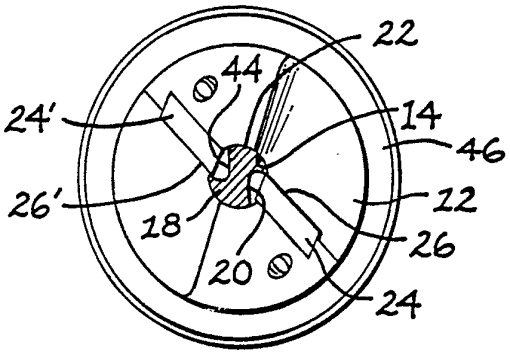
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FIG 3

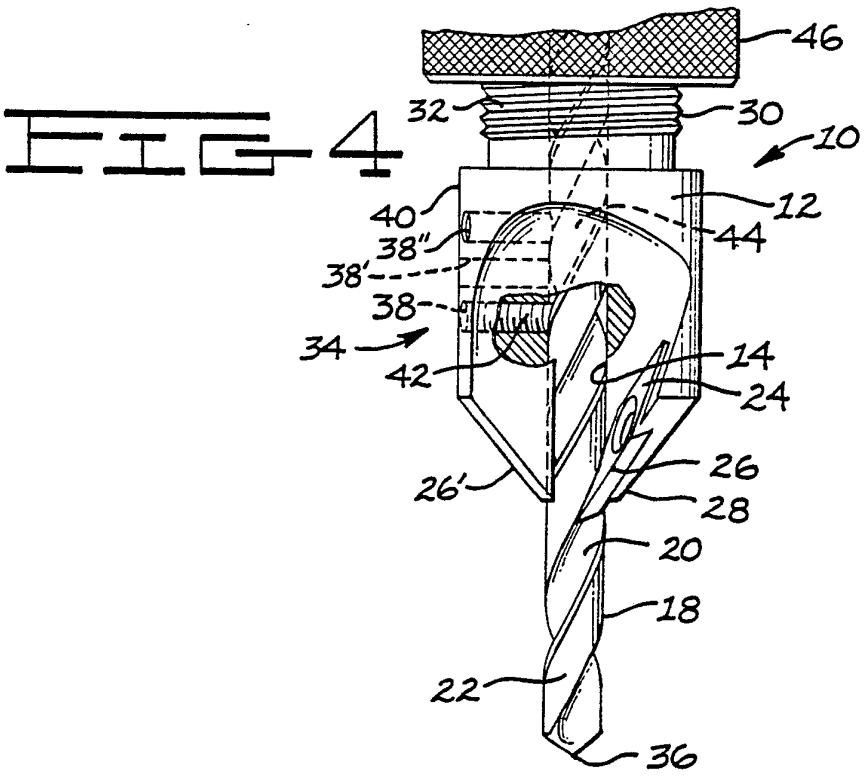
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FIG 4

# INTERNATIONAL SEARCH REPORT

International Application No PCT/US 85/01919

## I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [5]

According to International Patent Classification (IPC) or to both National Classification and IPC

IPC[4]: B 23 B 51/10

## II. FIELDS SEARCHED

Minimum Documentation Searched [7]

| Classification System | Classification Symbols |
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| IPC[4] | B 23 B 51/00 |

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched [8]

## III. DOCUMENTS CONSIDERED TO BE RELEVANT [9]

| Category * | Citation of Document, [11] with indication, where appropriate, of the relevant passages [12] | Relevant to Claim No. [13] |
|---|---|---|
| X | GB, A, 25372 (A.D. 1911) (BROADBENT) 25 July 1912, see page 2, lines 24-44; figures 1-4 | 1-4,8-11 |
| X | GB, A, 570099 (TAYLOR) 21 June 1945, see page 4, lines 42-74; figure 3 | 1-4,8-11 |
| A | US, A, 4293254 (MARKOVICS) 6 October 1981, see column 3, lines 3-6; figure 1 | 7 |
| A | GB, A, 258692 (PATTERSON) 21 October 1926 | |
| A | US, A, 4353670 (JORGENSON) 12 October 1982 | |
| A | US, A, 2344143 (HARDING) 14 March 1944 | |

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## IV. CERTIFICATION

| Date of the Actual Completion of the International Search | Date of Mailing of this International Search Report |
|---|---|
| 25th February 1986 | 10 MARS 1986 |
| **International Searching Authority** | **Signature of Authorized Officer** |
| EUROPEAN PATENT OFFICE | M. VAN MOL |

ANNEX TO THE INTERNATIONAL SEARCH REPORT ON

INTERNATIONAL APPLICATION NO. PCT/US 85/01919 (SA 10981)

This Annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report. The members are as contained in the European Patent Office EDP file on 04/03/86

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| Patent document cited in search report | Publication date | Patent family member(s) | Publication date |
|---|---|---|---|
| GB-A- 25372 | | None | |
| GB-A- 570099 | | None | |
| US-A- 4293254 | 06/10/81 | None | |
| GB-A- 258692 | | None | |
| US-A- 4353670 | 12/10/82 | None | |
| US-A- 2344143 | | None | |